



National Transonic Facility

NASA Langley Research Center

*Since 1982, The Langley National
Transonic Facility (NTF) has provided
the highest quality flight Reynolds number
aeronautical data to the research, industry,
and DoD communities.*



**Wind Tunnel
ENTERPRISE**

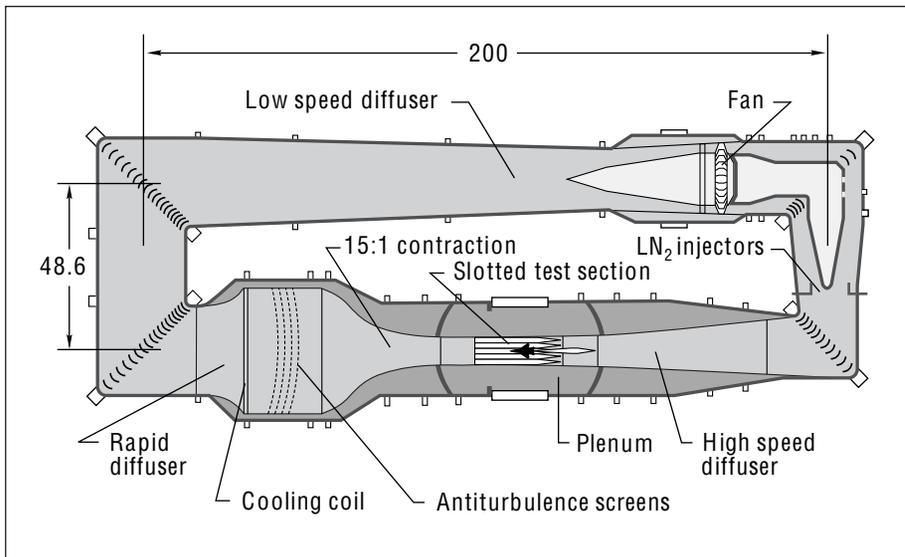
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Test Section and Performance

The Langley National Transonic Facility (NTF) is a high pressure, cryogenic, closed-circuit wind tunnel. The test section has 12 slots and 14 reentry flaps in the ceiling and floor to prevent the near-sonic flow “choking” effect. To ensure minimal energy consumption, the interior of the pressure shell is thermally insulated. The drive system consists of a fan with variable inlet guide vanes for responsive Mach number control. The fan is powered by a 100-MW motor.

The tunnel has two modes of cooling. In the variable temperature cryogenic mode, nitrogen is the test gas. Liquid nitrogen is sprayed into the circuit. The heat of vaporization and latent heat cools the tunnel structure while removing the fan heat. In this mode, the NTF tunnel provides full-scale flight Reynolds numbers without an increase in model size.

In the ambient temperature air mode, air is the test gas. Water flows through the cooling coil to remove fan heat.



NTF tunnel circuit arrangement. Dimensions in feet.

Type of Testing



Alpha Jet model.

The NTF provides testing in support of stability and control, cruise performance, stall buffet onset, and configuration aerodynamics validation for both full-span and half-span models. The NTF staff can model the customer's test objectives and test priorities utilizing a computerized test process simulator to design the most efficient test plan strategy with respect to cost, duration, and consumables.

NTF Characteristics

Mach number	0.1 to 1.2
Reynolds number, per foot	4×10^6 to 145×10^6
Pressure, psia	15 to 130
Temperature, degrees F	-250 to 150
Test gases	Nitrogen, Air
Test section size, feet	8.2 x 8.2
Length, feet	25
Area, square feet	66.8
Contraction area ratio	14.95:1
Circuit length, feet	497
Drive power, horsepower	135,000

Model Supports



Pathfinder II model.

The model support system is a circular arc sector that provides an angle-of-attack range of -11.5° to 19.0° at a rate of up to 4° per sec. The strut incorporates a roll drive with a range of -90° to 180° which, in conjunction with the pitch of the strut, is able to provide pitch and yaw data. The normal force load capacity of the strut is 27,000 lbs. Several sting and strut combinations are available for testing of aerodynamic models.

Safety and Design Criteria

Langley's LHB 1710.15 *Wind Tunnel Model System Criteria* is the guideline for model design and fabrication. Model installation and any exceptions to this document must have the approval of the NTF Safety Head on a case-by-case basis to assure personnel and tunnel hardware are not exposed to risk. This document is available on the Wind Tunnel Enterprise web site at URL <http://wte.larc.nasa.gov>

Model Observation

The NTF video measurements system consists of electronic imaging cameras, processors, and display hardware used for model flow visualization; boundary layer transition detection; and wing deformation and optical angle-of-attack measurements.

Instrumentation

The NTF can accommodate various types of internal 6-component strain gage balances. Typical corrections to the balance are interactions, temperature effects, attitude tares, axes orientation, and pressure and momentum (flow) tares.

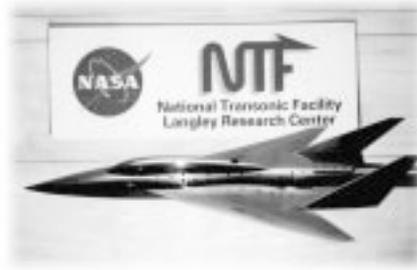
Onboard angle-of-attack (AOA) accelerometers are available that include thermal conditioning systems for cryogenic operation.

The electronically scanned pressure (ESP) system provides high accuracy measurement of model and facility pressures at rates up to 500 samples per sec. The modules are available in differential pressures of 2.5, 5, 15, 30, and 45 psi.

Data Acquisition and Processing

The NTF data acquisition system accepts analog, digital, and frequency (pulse-train) inputs and is controlled by a UNIX computer. The capacity of the system is 256 channels of analog data, 32 channels of digital data, and 1 frequency channel. A 14-track FM tape recorder for dynamic data acquisition is also available. Final data are reduced on a separate UNIX workstation. For data analysis, the NTF provides UNIX and Macintosh computers. Customer supplied computers can be networked to the data reduction system if desired. Secure data links are available for classified projects.

Test Techniques



Pathfinder II model in tunnel.

Several flow visualization techniques are available to investigate transition or separation locations on the model. Ultraviolet (UV) lighting is also available for fluorescent minitufts. A video model deformation system is available to optically ascertain deflection and rotation values of model components. Temperature sensitive paint (TSP) and pressure sensitive paint (PSP) techniques are currently being developed to acquire boundary layer transition and global surface pressure measurements.

Test Request Procedures

The first step of the test process is to submit a test request form. The form can be filled out electronically or printed for mailing at the Wind Tunnel Enterprise web site. A posttest questionnaire is also available

Facilities Available to Users

Three model buildup bays are provided at the facility for buildup of models. A calibration area provides the instrumentation systems for further calibrations that may be required to quantify deflection constants and weight tares.

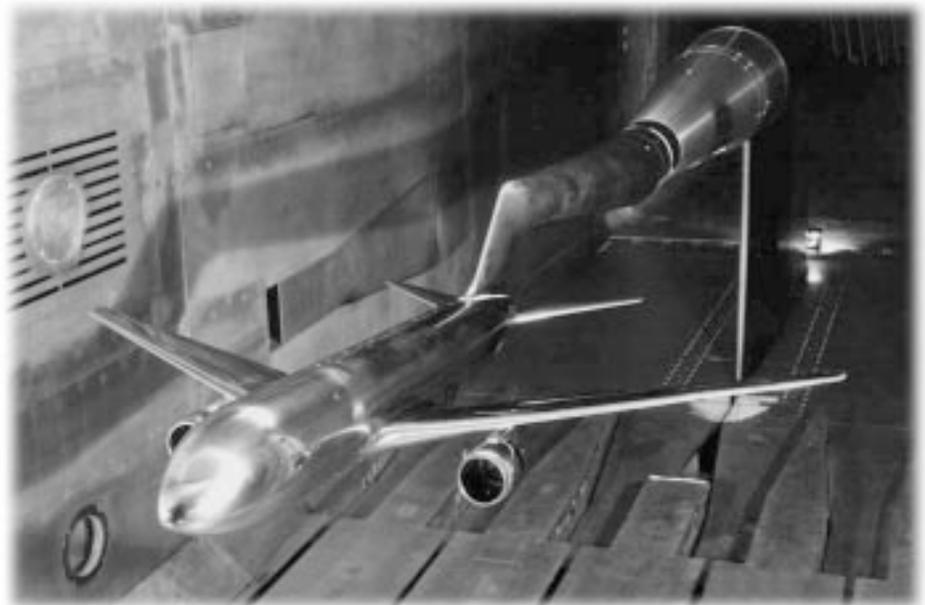
Facility Productivity Rates

The NTF has a proven record of successful tests and satisfied customers, with a capable staff to assist at all stages of testing from model design through final data analysis.

The average productivity rate for a given class of wind tunnel test in terms of data points per user occupancy hour (UOH) is

Performance test, points/UOH 20
Stability and control test, points/UOH . . 20

at this site. The URL is <http://wte.larc.nasa.gov>
Our customers are encouraged to provide feedback to the facility for our continuous improvement process.



Boeing 767 model in tunnel.

Operating Hours

The NTF operates
two shifts per day
Monday through Friday
7:00 am - 11:30 pm

Facility User's Guide

Additional facility information can
be found in the facility user's guide
at the Wind Tunnel Enterprise web site.
<http://wte.larc.nasa.gov>

For more information contact

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